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⑤④レンズ光学検査装置

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明　細　書

1、発明の名称

レンズ光学検査装置

2、特許請求の範囲

板状レンズを段積みし上段より取出し可能な複数のリフター付ストッカー、複数の移載ヘッドならびに搬送コンベアーからなるレンズ供給部と、駆動ローラーによる連続搬送中に、前記レンズと投光器の間に位置し、放射状細線入りの透明円板を光線に対して平行な軸に連続回転させ、レンズを透過した断続光を検知する受光部を有し、レンズの解像度と光量を検査する光学検査部と、前記レンズの幅寸法を自動計測するレンズ幅測定部と、円板表面と受光面の中心にレンズ中心を合せる自動調芯部と、搬送コンベアーと印刷部とリフター付ストッカーを有するレンズ取出部とを備えたレンズ光学検査装置。

3、発明の詳細な説明

産業上の利用分野

本発明は板状レンズ、特に複写機のレンズとして使用されるＳＬＡ（SELFOCK LENS ALLEY）の縦と横の解像度及び光量を自動的に検査する装置に関するものである。

従来例の構成とその問題点

従来のこの種の検査装置は第１図及び第２図に具体構成を示すように本体１の上に取付けられた２列のスライド軸受２，３によって摺動自在に支持された可動テーブル４がモーター５より継手６を介して両端で回動自在に支持されたボールネジ７によって左右に移動する。前記可動テーブル上には貫通溝部８を有し、この溝のテーブル上面に接してテーブル進行方向と直角方向に所定のピッチで細線が切られた透明のガラス板９が取付けられている。この透明ガラス板９の上方に間隔を保ってテーブル上のクランプ部１０，１１によってレンズ１２が上下に光を通過する様に取付けられている。このレンズの取付け、取はずしは作業者によって行われる。前記透明ガラスの下方には固定の本体に取付けられ、上方の透明ガラス及びレンズ１２に向って光を発する投光器１３を有し、

さらに本体に固定されたフレーム１４によってレンズ１２の上方に一定間隔を保って取付けられレンズを透過した光の量を検知する受光器１５を有する。

以上のように構成されたレンズ検査装置について、以下その動作を説明する。

まず、作業者によってレンズ１２がテーブル４上のクランプ部１０，１１に上下方向に光が透過するようにセットされる。次に作業者がスイッチを入れて、モーター駆動によりテーブル４を一定の速度で前進させる。この移動中にレンズ１２の下方に設けられた投光器１３より平行光を発し、所定のピッチで細線が切られた透明ガラス（以下パターンと呼ぶ）とレンズ１２を透過し、レンズ１２上方に設けられた受光器１５で断続光が検知される。この連続した光の強さを微小ピッチ毎にデーターとして記録することによりレンズ表面の傷、くもり、欠け等の不良が検査できる。

しかしながら上記のような構成では作業者がレンズを検査装置に１個づつ取付け、手動焦点合せ、検査スタートスイッチ押し，レンズ取はずし、データーからの良否判定、良品不良品の振り分けなど作業者が１台の検査装置を使って多くの作業を行なっていた。

このためレンズの検査の生産性が極端に悪くしかも目視による焦点合せやレンズ取付け状態のバラツキが発生しやすく検査結果の信頼性も低いという欠点を有していた。

発明の目的

本発明は上記欠点に鑑み、レンズ検査を全自動化して生産性を大幅に高め、さらに自動焦点合せ等により検査精度を高めることを提供するものである。

発明の構成

本発明は板状レンズを段積みし上段より取出し可能な複数のリフター付ストッカーと複数の移載ヘッドと搬送コンベアーとからなるレンズ供給部を設けることによりレンズの供給の自動化がはかられ、生産性が大幅に向上するという効果がある。

またレンズ供給部より１個づつ供給されたレンズは駆動ローラーによる連続搬送中にレンズと投光器の間に位置し、放射状細線入りの透明円板を光線に対して平行な軸に連続回転させ、レンズを透過した断続光を検知する受光部を有し、レンズの解像度を４項目，光量を１項目を順次連続して検査する光学検査部を設けることにより、大幅な生産性の向上がはかれると同時に、全てのレンズが同一条件で検査ができるため検査の信頼性が向上する。

またレンズの幅寸法を高精度に自動計測し、その計測結果に基いて円板表面と受光面の中心にレンズ中心を自動的に合せる自動調芯部を備えることにより、検査結果の信頼性が高められ高生産性を得ることができる。

さらに搬送コンベアーと検査結果に基く良品と不良品の仕分け品のリフター付ストッカーと印刷部を設けることにより同じく、生産性を高めることができる。

実施例の説明

以下本発明の一実施例について図面を参照しながら説明する。

第３図は本発明の実施例におけるレンズ光学検査装置の全体を示すものである。第３図において１６，１７，１８はそれぞれ独立して駆動部１９，２０，２１をもったリフター付ストッカーで、レンズ２２が段積みされて最上段より取出し可能である。２３，２４，２５はレンズ移載装置で、先端にはそれぞれ吸着チャック２６，２７，２８が取付けられ、前記リフター付ストッカーから一個づつレンズを取出す。２９は前記リフター付ストッカーとレンズ移載装置の間に位置して、レンズを搬送するベルトコンベアーである。この３連のレンズ供給部３０は一連が動作中に他の２連で作業者によるレンズの段積み等の準備を行うものである。３１は検査部の架台，３２は精密定盤，33は検査部のレンズ搬送装置で、検査部にはそれぞれの検査装置部に１個づつのレンズが搬送される。３４は電気マイクロメーターの測定子３５を前後に移動させ、レンズ側面に当接してレンズ幅を測定するレンズ幅測定装置である。３６は縦短ピッ

チ解像度検査部、３７は横短ピッチ解像度検査部、３８は縦長ピッチ解像度検査部、３９は横長ピッチ解像度検査部、４０は光量検査部である。４１，４２，４３，４４，４５は各々の検査部の光源となる投光器、４６，４７，４８，４９はレンズと前記投光器との間に設けられそれぞれモーターによってレンズ搬送速度とほぼ同期して回転する円周に放射状の細線が入った透明の円板でできたパターン、５１，５２，５３，５４，５５は前記レンズを透過した断続光を検知する受光管であり、レンズに対してパターンの反対側に位置する。５６，５７，５７，５８，５０はそれぞれ前記発光管，パターン，受光管をレンズに対して所定の位置に移動，位置決めできる自動調芯テーブルである。６０は光学検査部全体を示し、６１は電気制御ボックスを示す。６２は光学検査を終ったレンズを搬送するベルトコンベアー、６３は良品番号印刷機、６４は不良品番号印刷機、６５は不良品を段積みするリフター付ストッカー、６６は前記ベルトコンベアーよりリフター付ストッカーへレンズを移載するレンズ移載装置、６７は同じく吸着チャックヘッドである。６８は良品レンズ段積み装置、６９は良品レンズ移載装置、７０は同じくチャック、７１は良品ストックコンベアーであり前記良品レンズ段積み装置で一定枚数に積重ねられたレンズを１ブロックごと移載してストックされる。７２はレンズ取出部全体を示す。

以上のように構成されたレンズ光学検査装置について、以下その動作を説明する。

まず、作業者によって予め積み込まれたレンズ２２は最上段より一個づつレンズ移載装置でベルトコンベアー２９上にのせられ、コンベアー２９で搬送されてレンズ検査部６０の搬送部に順次送り込まれる。検査部６０に到着したレンズはレンズ幅測定装置３４によって幅寸法が測定され、この測定結果に基いて縦短ピッチ解像度検査部３６，横短ピッチ解像度３７，縦長ピッチ解像度検査部３８，横長ピッチ解像度検査部３９，光量検査部４０と順次各ポジションごとに自動調芯テーブルによってレンズに対するパターン表面と受光管表面の位置を自動的に合せ、自動焦点合せをした状態で各検査を行っていく。検査が終ったレンズはレンズ取出し部７２のベルトコンベアーに送り出され、検査項目のそれぞれの値が基準値からはずれたレンズは不良品番号を、基準値範囲内のレンズは良品番号をそれぞれ自動印刷され、不良品は不良品移載装置によってベルトコンベアー上から不良品のリフター付ストッカーへ移載され上から一枚づつ段積みされる。また良品のレンズはベルトコンベアーの最終端で良品レンズ段積み装置によって一定枚数づつ下から積み重ねられ、一定枚数ごとに良品レンズ移載装置によって良品ストックコンベアーまで移載される。

発明の効果

以上のように本発明はレンズ供給部と、光学検査部と、レンズ幅測定部と、自動調芯部と、レンズ取出し部とを設けることによりレンズの光学検査を全自動化して生産性を大幅に高め、さらに自動焦点合せ等による検査精度を向上することができ、その効果は大なるものがある。

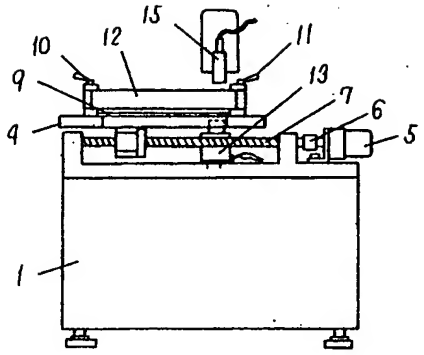
４、図面の簡単な説明

第１図は従来のレンズ光学検査装置の正面図、第２図は同側面図、第３図は本発明の実施例における斜視図である。

１６，１７，１８……リフター付ストッカー、２２……レンズ、２６，２７，２８……移載ヘッド、３０……レンズ供給部、４１，４２，４３，４４，４５……投光器、３３……レンズ搬送部、４６，４７，４８，４９……パターン、３４……レンズ幅測定部、５１，５２，５３，５４，５５……受光器、６０……光学検査部、５６，５７，５８，６９，６０……自動調芯部、６２……搬送コンベアー、６３，６４……印刷部、６５……リフター付ストッカー、７２……レンズ取出部。

代理人の氏名　弁理士　中　尾　敏　男　ほか１名

第 1 図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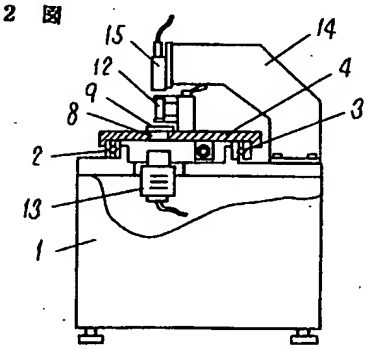
第 2 図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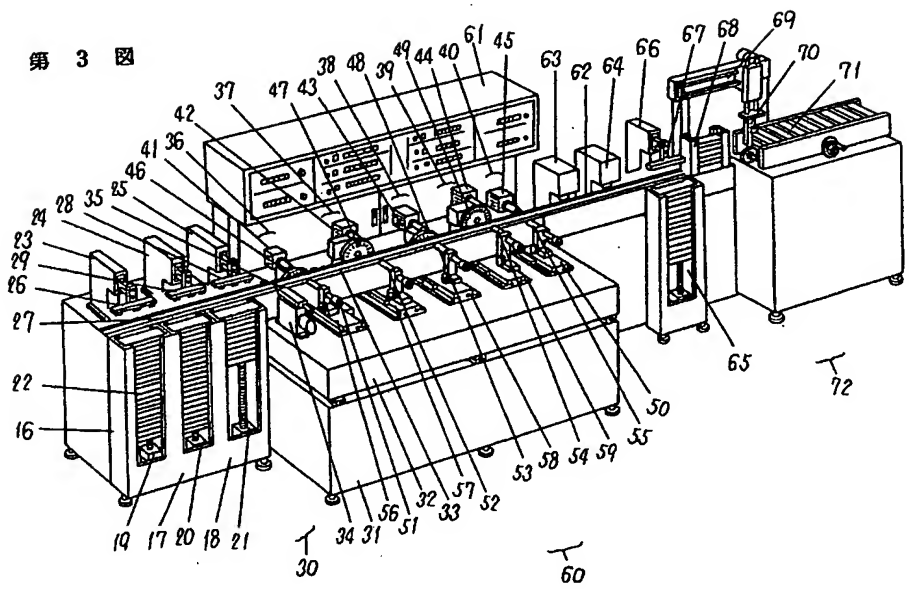
第 3 図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(54) Lens Optical Inspection Apparatus

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SPECIFICATION

1. Title of the Invention

Lens Optical Inspection Apparatus

2. Claims

A lens optical inspection apparatus that is equipped with a lens supply part that is comprised of several filter-equipped stockers that can extract a plate shaped lens from the top stage of a stacker, several transfer heads and a transport conveyor, an optical inspection component that is positioned, during continuous transport by a drive roller, between the aforementioned lens and a floodlight projector, that continually rotates a transparent disk containing irradiating fine lines on an axis parallel to the light rays, that has a light receiving part that detects intermittent light that passes through the lens and that examines the degree of resolution of the lens and the quantity of light, a lens width control part that automatically controls the width dimension of the aforementioned lens, an automatic core adjustment part that aligns the center of the lens with the center of the disk

surface and the light receiving surface and a lens extraction part that has a transport conveyor, a printing part and a lifter-equipped stocker.

3. Detailed Description of the Invention

Field of Industrial Use

This invention relates to a plate-shaped lens, and, in particular, it relates to an apparatus that automatically inspects the longitudinal and transverse degree of resolution and quantity of light of SLA (Selfock Lens Alley) that is used as a lens for copy images.

Structure of a Conventional Example and Problems Thereof

The specific structure of this type of conventional inspection apparatus is shown in Figure 1 and Figure 2. As shown, the movable table 4, which is installed on the body 1 and which is supported so that it slides freely by the two rows of slide bearings 2 and 3, is moved left and right by the ball screw 7, which is supported so that it rotates freely at both ends through the agency of the coupling 6. There is a penetrating groove 8 on the aforementioned movable table and the transparent glass plate 9, which is cut by fine lines at specified pitches, is installed in the direction perpendicular to the direction of advance of the table in contact with the table surface of this groove. The lens 12 is installed so that it is held by the clamps 10 and 11 on the table at a distance above the transparent glass plate 9 and so that light passes through it from top to bottom. Installation and removal of the lens is performed by the operator. Below the aforementioned transparent glass plate, there is the floodlight projector 13, which is installed in the fixed body and which emits light toward the top transparent glass and the lens 12 and there is the light receptor 15, which is held and installed at a fixed interval above the lens 12 by the frame 14, which is affixed in the body, and which detects the quantity of light that passes through the lens.

We shall now describe the operation of the lens inspection apparatus that is constructed as indicated above.

First, the lens 12 is set by the operator in the clamp parts 10 and 11 on the table 4 so that light passes through it from top to bottom. Next, the operator turns on the switch and the table 4 is advanced at a fixed speed by the motor drive. During this movement, parallel light is emitted by the floodlight projector 13, which is installed below the lens 12, passes through transparent glass which is cut by fine lines at specified pitches (hereafter called pattern) and the lens 12 and intermittent light is detected by the light receptor 15, which is installed above the lens 12. Such problems as damage, cloudiness or defects of the lens surface are inspected by continuous recording of the intensity of the light at very small pitches as data.

However, with the structure described above, the operator installs one lens at a time in the inspection apparatus and the operator performs many operations such as manual focusing, pushing the inspection start switch, removing the lens, evaluation of quality from the data and separation of good and poor quality products using a single inspection apparatus.

For this reason, there are the drawbacks that the productivity of lens inspection is extremely poor, variations occur in visual focusing and in the state of lens installation and that the reliability of the results of inspection is low.

Objective of the Invention

In the light of the drawbacks described above, the objective of this invention is to make lens inspection completely automatic, bring about a great increase in productivity and to increase inspection precision by automatic focusing.

Structure of the Invention

This invention has the effects of making lens supply automatic by installing a lens supply part that is comprised of several lifter-equipped stockers that can extract plate-shaped lenses from the top stage of a stacker, several transfer heads and a transport conveyor and of greatly improving productivity.

Further, it has a light receiving part which, during continuous transport of the film by the drive motor, is positioned between the lens and the floodlight projector, which causes continuous rotation of a transparent disk containing irradiating fine lines on an axis parallel to the light rays and which detects intermittent light that has passed through the lens, an optical inspection component being installed that successively and continuously inspects four items relevant to the degree of resolution of the lens and one item of light quantity, by which means a great increase in productivity is achieved, and, at the same time, all of the lenses can be inspected under identical conditions with the result that reliability is increased.

Further, by installing an automatic core adjustment part that automatically measures the width dimension of the lens with high precision and that, as a result of this measurement, automatically aligns the center of the lens with centers of the disk surface and the light receiving surface, the reliability of inspection results can be improved and high productivity can be obtained.

In addition, productivity can similarly be increased by installing a transport conveyor, a lifter-equipped stocker of products classified as good or poor on the basis of the inspection results and a printing component.

Description of an Example

We shall now describe an example of this invention by reference to the figures.

Figure 3 shows the entire body of a lens optical inspection apparatus that is an example of this invention. In Figure 3, 16, 17 and 18 are lifter-equipped stockers that are independent, that have the drive components 19, 20 and 21 and on which the lenses 22 are stacked so that they can be extracted from the topmost step. 23, 24 and 25 are lens transfer devices in the tips of which are installed the adsorptive chucks 26, 27 and 28 and which extract the lenses one-by-one from the aforementioned lifter-equipped stockers. 29 is a belt conveyor that is positioned between the aforementioned lifter-equipped stockers and the lenses and that transports the lenses. While one of the series of three lens supply components 30 is in operation, adjustment of lens stacking is performed by the operator on the other two of the series. 31 is the frame stand of the inspection component, 32 is a precision fixed disk and 33 is the lens transport device of the inspection component which transports lenses one by one to the inspection apparatus parts in the inspection part. 34 is a lens width measurement apparatus that moves the gage element 35 of the electric micrometer backwards and forwards and that measures the lens width in contact with the side of the lens. 36 is the longitudinal short pitch degree of resolution inspection component, 37 is the transverse short pitch degree of resolution inspection component, 38 the longitudinal long pitch degree of resolution inspection component, 39 is the transverse long pitch degree of resolution inspection component, and 40 is the quantity of light inspection component. 41, 42, 43, 44, and 45 are floddlight projectors that serve as the light sources of the various inspection components, 46, 47, 48 and 49 are patterns that are formed on transparent disks on which irradiating fine lines are cut that are installed between the lens and the aforementioned floodlight projectors that are rotated essentially in synchronism with the lens transport speed by means of respective motors and 51, 52, 53, 54 and 56 are light receiving tubes that detect intermittent light that has passed through the aforementioned lens and that is positioned on the opposite side of the pattern relative to the lens. 56, 57, 57, 58 and 50 [sic. probable typographical error for 56, 57, 58, 59] are automatic core adjustment tables that can be moved and positioned in specified positions relative to the aforementioned light emission tube, pattern and light receiving tube. 60 shows the entire optical inspection component and 61 shows the electrical control box. 62 is the belt conveyor that transports the lens optical inspection which has been completed, 63 is the good product number printer, 64 is the defective product number printer, 65 is the lifter-equipped stocker that stacks the defective products, 66 is the lens transfer apparatus that transfers the lens to the lifter-equipped stocker by means of the aforementioned belt conveyor and 67 is, similarly, an adsorptive chuck head. 68 is a good product lens stacking apparatus, 69 is a good

product lens transfer apparatus, 70 is, similarly, a chuck and 71 is a good product stock conveyor that transfers and stocks lenses that have been stacked in a fixed number by the aforementioned good product lens stacking apparatus onto a single block. 72 shows the entire lens extraction component.

We shall now describe the action of the lens optical inspection apparatus that is constructed as described above.

First, the lenses 22, which have been stacked in advance by the operator, are placed one by one on the belt conveyor 29 from the topmost step by the lens transfer apparatus and are then transported by the conveyor 29 and fed in succession to the transport component of the lens inspection component 60. The width dimension of a lens that has reached the inspection component 60 is measured by the lens width measurement apparatus 34, and, on the basis of the results of measurement, the positions of the pattern surface and the light receiving tube surface relative to the lens are automatically aligned successively for the positions of the longitudinal short pitch degree of resolution inspection component 36, the transverse short pitch degree of resolution inspection component 37, the longitudinal long pitch degree of resolution inspection component 38, the transverse long pitch degree of resolution inspection component 39, and the quantity of light inspection component 40 and inspection of each is performed in an automatically focused state. A lens of which inspection has been completed is sent out to the belt conveyor of the lens extraction component 72, defective product numbers are automatically printed on lenses for which the respective values of the inspection items fall outside the reference values, good product numbers are automatically printed on lenses of values within the reference value range and the defective products are moved from the belt conveyor to the defective product lifter-equipped stocker by the poor product transfer apparatus and are stacked one by one from the top. The good product lenses are stacked one by one from the bottom by the good product lens stacking apparatus at the bottommost end of the belt conveyor and transferred to the good product stock conveyor in fixed numbers by the good product lens transfer apparatus.

Effect of the Invention

This invention as described above, as the result of the fact that a lens supply component, an optical inspection component, a lens width measurement component, an automatic core adjustment component and a lens extraction component are installed, has the great effect that optical inspection of the lens is completely automated, with productivity being greatly decreased, and that inspection precision can be increased by automatic focusing.

4. Brief Explanation of the Figures

Figure 1 is a frontal view of a conventional lens optical inspection apparatus, Figure 2 a lateral view of the same and Figure 3 is an oblique view of an example of this invention.

16, 17, 18 --- lifter-equipped stocker; 22 --- lens; 26, 27, 28 --- transfer head; 30 --- lens supply component; 41, 42, 43, 44, 45 --- floodlight projector; 33 --- lens transport component; 46, 47, 48, 49 --- patterns; 34 --- lens width measurement component; 51, 52, 53, 54, 55 --- light receiving component; 60 --- optical inspection component; 56, 57, 58, 59, 60 --- automatic core adjustment components; 62 --- transport conveyor; 63, 64 --- printer component; 65 --- lifter-equipped stocker; 72 --- lens extraction component.

Name of Agent:
Toshio Nakao, Patent Attorney, And 1 Other

Figure 1

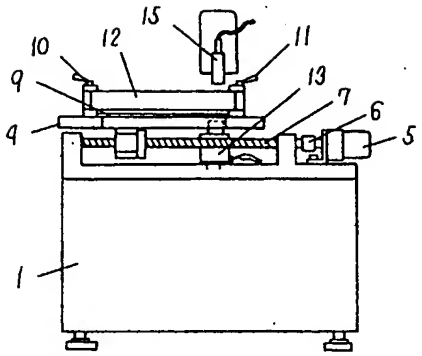

Figure 2 第 2 図

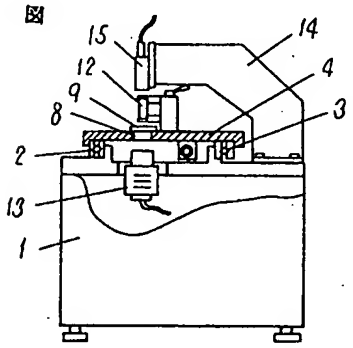

Figure 3 第 3 図